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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER
KORNAKOV, MICHAIL

ART UNIT	PAPER NUMBER
1746	11

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/742,423	MATSUNO ET AL.	
	Examiner	Art Unit	
	Michael Kornakov	1746	

-- The MAILING DATE of this communication appears on the cover sheet with the c rrespondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03/20/3003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *1-23* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

1. Claims 1, 3-20 are examined on the merits. Claims 2 and 21-23 stand withdrawn from consideration.

2. Claim 1 has been amended to introduce the limitation "in tandem", which is understood as a consecutive treatment of substrate with ozone and hydrogen water.

3. Claim 3 as presently amended is interpreted as a Markush recitation for the types of substrates to be cleaned. Amendment to claims 8 and 9 removed the ambiguity addressed in 112 second paragraph rejection in the previous Office Action.

4. Applicant's arguments with respect to claims 1, 3-20 have been considered but are moot in view of the new ground(s) of rejection.

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 1, 3-5, 9, 10, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eui-Yeol (U.S. 6,035,871).

With regard to claims 1, 3, and 12 US'871 discloses a process and a cleaning apparatus (13) in Fig.1 where the cleaning of semiconductor substrates is performed during semiconductor fabrication (abstract). A cleaning is provided in a cleaning room in which there are disposed a holder for rotatably holding an object to be treated, **an ozonized water supply nozzle is supplying ozonized water to the treated object**, and a hydrogenated water supply nozzle **is supplying hydrogenated water to the treated object** (col. 2, lines 40-50). Substrates for liquid crystal display devices, which

include silicon films formed on their surfaces, were prepared and used as samples (col. 9, lines 9, 10).

With specific regard to claims 4 and 5, US'871 teaches that hat impurities adhering to the treated object are in the form of particles and organic substances, and that these particles and organic substances can be removed by performing spin cleaning (rotation cleaning) while **both ozonized water and hydrogenated water are used as chemical fluids** (col. 3, line 57, through col. 4, line 5). With regard to claim 9, US'871 teaches, that ultrasonic vibrator is applying ultrasonic waves to the hydrogenated water (col.5, lines 24-29). With regard to claim 10, the substrate is cleaned under rotation in US'871, a cleaning apparatus provided with a cleaning room in which there are disposed a holder for **rotatably holding** an object to be treated, an ozonized water supply nozzle for supplying ozonized water to the treated object, and a hydrogenated water supply nozzle for supplying hydrogenated water to the treated object (col. 2, lines 40-45). With regard to "tandem" limitation, as interpreted and discussed above, the teaching of US'871 in col. 3, lines 60-67; col.6, lines 56-60, and in col. 8, lines 14-25 suggests to skilled artisan to perform the processing steps in sequence. "[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom", consult In re Preda, 401 F.2d 825, 826,159 USPQ 342, 344 (CCPA 1968). Applicant is reminded that if it can be logically deduced that the reference will imply something to one of ordinary skill in the art, that the reference

doesn't come right out and say, then logical reasoning will make that reference evidence for its implicit disclosure, as well as for its explicit disclosure.

Therefore, following by implicit disclosure of US'871, one skilled in the art would have found it obvious to utilize the step of supplying ozonized water and hydrogenated water one after another with the reasonable expectation of success.

7. Claims 6, 7 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over US'871 in view of Yeol (U.S. 5,983,909).

US'871 is silent about the optimal concentrations of ozone and hydrogen in ozone and hydrogen water.

Yeol discloses a similar process, which only differs by an addition of pH adjusting agents (alkaline or acidic) into ozone water and hydrogen water respectfully, wherein ozone and hydrogen water is prepared identically the the one of US'871 and identically to the one of the instant claims. Yeol further teaches that **ozone concentration** of 8 to **10 PPM** in the ozone water (col. 9, lines 4, 5, 47, 48), thus 10ppm as being the end point of the range anticipates the limitation of the instant claim 6.

With regard to the limitation of the instant claim 7, Yeol teaches that hydrogen concentration in hydrogen water is 1-2 PPM, thus anticipating the instantly claimed "not lower than 0.5 PPM". Therefore, a person skilled in the art based on similarity of US'871 and Yeol's processes and utilization of similar cleaning solutions would have found it obvious via routine experimentation to adjust the concentrations of ozone and

hydrogen in the process of US'871 according to the embodiments of Yeol with the reasonable expectation of success.

With specific regard to claim 20, Yeol discloses that an acidic solution such as **HF**, HNO3, etc., can be mixed with hydrogen water in apparatus (D) 9 on Fig.1A, and depending on the sequence of treatments can be used after the ozone water treatment is performed. When an acidic solution such as HF, is mixed with ozone water in the mixing apparatus (C) 8 on Fig.1A, an aqueous oxidizing acidic cleaning solution is produced, and can be used before or after hydrogen containing water is applied.

On the other hand, US'871 motivates a person skilled in the art to utilize different chemical additives for adjusting pH and/or better removing particles. Therefore, a person skilled in the art at the time the invention was made would reasonably expect the improvement of particles removal if the HF treatment is performed along with or after either of steps disclosed in US'871.

8. Claims 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eui-Yeol (U.S. 6,035,871) in view of Numano et al (U.S. 5,739,575).

The US'871 does not teach the use of ashing before either of the steps, ozone water treating step, or hydrogen water treating step.

However, a person skilled in the art will find a motivation in US'871 to perform such operation, since US'871 teaches that both particles and organic substances adhering to the substrate to be cleaned can be effectively removed (col. 3, lines 60). This means that aqueous cleaning solutions can be applied to cleaning substrates after

a resist-forming step or after etching step, thus leaving organic contaminants on substrate.

Removal of photoresist contaminants by ashing followed by a washing process is notoriously used in the art.

Thus, Numano discloses a method of manufacturing dielectrically isolated substrate. FIG. 6B shows that the photoresist pattern 48 is removed by ashing in a dry atmosphere with ozone (O_3). After that, the substrate 41 is washed in order to remove the by products left after ashing (col. 5, lines 60-65 and Fig. 6B).

Since US'871 aims to remove organics along with other types of contaminants, and Numano does remove photorsesist by ashing followed by washing, a person skilled in the art would have found it obvious to utilize ashing with ozone as per Numano in the process of US'871 before washing in order to achieve better removal of organic contaminants and to reduce the time required for treatment with ozone and/or hydrogen water and thus to arrive at the instantly claimed subject matter. With regard to the amount of ozone in ozone containing gas, as per claim 18, the ashing process of Numano is performed by pure ozone gas, wherein commercially pure ozone inherently contains at least 99.5 vol.% of ozone.

9. Claims 8, 11, 13, 14 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over US'871in view of Carter et al (U.S. 6,080,531).

US'871 is silent about the rate of ozone water, as per claim 8 and about the value of rotation speed of a substrate, as per claim 11.

Carter discloses an improved method for removal of photoresist by applying the treatment solution containing ozone dissolved in a pure water (abstract, Fig.3, col. 2, lines 65-67, col. 3, lines 1,2). According to Carter all experiments were performed, while wafer was rotated at 999 rpm, and while the total flow of cleaning liquid through the wafer was 1.2-1.32 L/min. These two parameters are within the range of claims 8 and 11.

Since US'871 teaches the rotation of wafer with a very high speed, as discussed supra and since both US'871 and Carter perform similar process steps with similar purpose to remove organic contaminants from the surface of wafer, a person skilled in the art at the time the invention was made would have found it obvious to rotate wafer at the speed of Carter and apply the analogous cleaning solution with the rate of Carter in order to achieve the optimum efficiency of cleaning.

US'871 discloses a method as instantly claimed. However, it does not specifically recognize the step of treating substrate with an organic solvent before either one of washing steps, as per claim 19.

Carter discloses an improved method for removal of photoresist by applying the treatment solution containing ozone dissolved in a pure water (abstract, Fig.3, col. 2, lines 65-67, col. 3, lines 1,2). When the underlying substrate includes metal lines, inorganic acid mixtures are not suitable to remove the photoresist, as they will damage the metal lines. Various organic solvents, such as N-methyl-pyrrolidone (NMP), may be used to remove the undesired photoresist without harming the metal lines. Thus, a skilled artsian would have found it obvious to pre-treat the substrate of US'871 with an

organic solvent as disclosed by carter before the treatment step in order to loosen the surface of organic film, to ensure better diffusion of subsequent washing solution, and thus to achieve better removal in a shorter period of time.

With regard to claims 13 and 14 US'871 teaches that after being washed with cleaning solutions, the substrate is dried with **nitrogen gas** or the like, and then transferred to the discharge section. US'871 does not teach that the treatment is performed at a temperature not lower than 30^{o}C.

According to Carter all experiments were performed, while wafer was rotated at 999 rpm, and while the total flow of cleaning liquid through the wafer was 1.2-1.32 L/min (col. 10, lines 46-52) and temperatures of treating solutions can be within the range of 0-100^{o}C (col. 7, lines 35-37).

Based on the similarity of methods of US'871 and Carter and similarity of cleaning solutions and substrates to be cleaned, a skilled artisan would have found it obvious to utilize the temperature range of Carter in a process of US'871 in order to ensure that sufficient concentration of ozone is present in water, and thus to arrive at the subject matter of claim 13.

10. Therefore, combination of references renders claims 1-6 prima facie obvious and properly rejected under 35 U.S.C. 103(a).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Kornakov whose telephone number is (703) 305-0400. The examiner can normally be reached on 9:00am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski can be reached on (703) 308-4333. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872 9310 for regular communications and (703) 872 9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308 2450.

M. KORNAKOV

Michael Kornakov
Examiner
Art Unit 1746

July 21, 2003